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Description

The invention relates to a blind rivet, and in particular to a blind rivet for anchoring in a relatively soft material, for example softwood.

Blind rivets, which are installed or placed by access to one side only of the workpieces, have been known and used for many years for use in applications in which the rivet protrudes from the blind or inaccessible side of two or more superposed sheets, and forms a blind head behind the blind face of the rear sheet. US3515028 describes a blind rivet of this known kind, and comprising a tubular shell, or "sleeve", and a stem or "pin" in the form of a blind fastener in accordance with the preamble of claim 1.

However there is also a requirement to secure a member to a body of relatively soft material, eg softwood, in such a way that neither the rivet, nor the hole in which it is inserted, breaks through the blind face of the body of relatively soft material.

Such an application raises different problems. The enlarged blind head must be formed, inside the body of relatively soft material, in such a way that the engagement of the blind head within the material is sufficiently strong to resist pull-out.

One problem with the use of the blind fastener of US 3515028 in such an application is that, on applying increasing tension to the stem so as to cause the stem head to enter the bore of the shell, the cutting elements and increasing diametral dimension of the stem head can cause the shank of the shell to be split into legs along a length of the shank much greater than the length of the weakened portion, and the long legs so formed can be forced outwardly, or splayed, so far as to cause splitting of the soft wood or other soft material. This is due primarily to the fact that the breakneck is so strong as to overcome much of the resistance to cutting and splaying offered by the shank, and consequently the shank is ruptured along a substantial part of its length before eventually the resistance of the shank to further splitting and splaying of the legs reaches a point at which the breakneck can no longer transmit the necessary force, and the breakneck fractures.

In rupturing and expanding the region of the shank beyond the thin walled weakened portion, the blind head so formed is formed at a position much nearer to the near face of the soft material than the weakened portion, so that the resistance of the soft material to pull-out of the rivet is less than if the blind head was deeper in the soft material and further from the near face.

We have found that, in order to avoid such problems, it is necessary to relate the strength of the breakneck to the construction of the shank in such a way that the breakneck is able to transmit sufficient force to rupture the thin walled, weakened portion and to force apart the legs so formed, but is not able to transmit sufficient force to significantly further rupture and deform the main part of the shank which is more resistant to rupture and deformation than the weakened portion.

The invention provides, in one of its aspects, a blind rivet for anchoring in relatively soft material, which rivet comprises a tubular shell and a stem; the tubular shell having a shank and a preformed head at one end of the shank, the shank having a main part adjacent to the preformed head, and a weakened expandable portion at the end thereof remote from the head, the weakened portion of the shell having a thinner wall than the next adjacent portion of the shell;

the stem extending through the tubular shell and having a pulling portion, a breakneck and an expander head disposed adjacent to the weakened expandable portion of the shell, the expander head having a maximum external diameter greater than the internal diameter of the thinner walled weakened portion of the shell and having a plurality of cutting elements on that side of the head which faces towards the weakened portion of the shell; at least part of the expander head increasing in diametral dimension towards the maximum diameter of the head; and the main part of the shank being more resistant to rupture and deformation than the weakened portion; such that, when the rivet is inserted into a bore in a body of material so that the expandable portion of the shell is located in the bore and spaced by a sufficient distance from the surface of the material at the accessible end of the bore, and increasing tension is applied to the stem on the side of the breakneck remote from the stem head, with respect to the head of the shell, the stem head progressively enters the weakened portion of the shell, the cutting elements causing the weakened portion of the shell to split into a plurality of legs, and the progressively increasing diametral dimension of the head causes the legs to be forced outwardly to anchor the rivet in the bore in the body of material, characterised in that the strength of the breakneck, and the resistance of the main part of the shank of the shell to rupture by the cutting elements and deformation by the stem head, are so related that the breakneck is not sufficiently strong to transmit the force necessary to cause further rupture and deformation of the shank so that the stem breakneck fractures before the stem head can advance substantially further into the shell beyond the weakened portion, thereby confining the splitting of the shell into radially expanded legs embedded in the material at the end of the shell spaced away from the surface of the material at the accessible end of the bore, with no substantial expansion of at least the major part

of the remaining length of the shell shank.

A specific embodiment of the invention will now be described by way of example and with reference to the accompanying drawings, in which:-

Figure 1 is a longtitudinal axial section through a rivet shell before assembly;

Figure 2 is a tail end elevation of the shell in the direction of the arrow 2 in Figure 1;

Figure 3A is an external elevation of the rivet stem before assembly;

Figure 3B is an end elevation of the stem in the direction of the arrow 3B in Figure 3A;

Figure 4 shows the assembled rivet with the shell in axial section and the stem in elevation;

Figure 5 is an elevation of the rivet placed in a softwood panel; and

Figure 6 illustrates two rivets used to secure a softwood panel to a frame-member.

Referring first to Figure 6, a softwood panel 11 is secured to a metal channel-section frame member 12 by means of a number of rivets, two of which are shown, after placing, at 13. It is a requirement that the face 36 of the softwood panel 11 which is remote from the frame member 12 is not distorted or broken by the riveting operation.

The rivet of this example comprises a shell 14 and a stem 15, both of steel. Figures 1 and 2 show the shell, which is tubular with a bore 16 completely through it, and comprises a shank 17 having a preformed head 18 at one end and a weakened portion 19 at the other, or tail, end. The external diameter of the shank is uniform, the weakened portion 19 having a thinner wall 21 than that 22 of the remainder, or main part, of the shank which is adjacent to it. The weakened portion meets the remainder of the shank in an annular sloping shoulder 23. The axial extent of the weakened portion 19 is between one quarter and one third of the total length of shell shank 14 excluding the head 18.

The stem 15 is shown in Figure 3 and comprises a pulling portion 26 joined by a breakneck 27 to a plugging portion 28. At the end of the stem remote from the pulling portion 26 is an expander head 29. The pulling portion 26 has a uniform diameter which is a close sliding fit in the shell bore 16. The major part of the length of the plugging portion 28 comprises a retaining portion 33 which is of uniform diameter slightly greater (in this example, by about 0.13 mm in a diameter of about 2.6 mm) than the uniform internal diameter of the major length part 20 of the shell bore 16. One end of the retaining portion 33 is joined to the breakneck 27 by a taper 34.

The head is provided with a plurality of cutting elements in the form of four sharp edges 24, each extending generally longitudinally of the stem and spaced equally at ninety degrees apart around the stem. Each cutting edge 24 is provided at the corner of a square sectioned part 41 of the head. The dimension of each side of the square is equal to the diameter of the portion 33 of the stem. Each cutting edge 24 comprises two parts, a leading part 24a which slopes outwardly (from the periphery of the end of the stem portion 33 to a corner of the square section 41), and a trailing part 24b which extends parallel to the stem axis. The diameter across the narrow end of the sloping cutting edges 24a is less than the internal diameter of the weakened portion 19 of the shell, whereas the diameter across the wider end, and across the parts 24b, is greater than that internal diameter. Next to the square-sectioned part 41 of the head is a portion 32, the external surface of which is, in elevational section, a smooth arcurate curve. The maximum external diameter of the expander head 29, over its short parallel portion 31 of uniform maximum diameter, is greater than the internal diameter of the thinner wall portion 19 of the shell and, in this example, is equal to the uniform external diameter of the shell shank 17 (see Figure 4). The end of the head has a slightly domed surface 30.

The assembled rivet is shown in Figure 4, the stem having been inserted through the bore of the shell until the inner periphery of the tail end face 25 of the shell shank meets the sloping leading parts 24a of the stem cutting edges. The free end part of the pulling portion 26 of the stem projects well beyond the head 18 of the shell. The leading part of the retaining portion 33 of the stem has been drawn into about half of the length of the part 20 of the shell bore, producing an interference fit. This interference holds the stem firmly assembled in the shell. The exterior of the corresponding part of the shell shank may have been slightly expanded by this interference fit of the stem portion 33 in part of the bore 20.

The rivet is used, in the usual way for blind rivets, by inserting the shell shank of the assembled rivet into a bore in which it is a close fit, until the underside of the head 18 abuts the near face of the workpiece or members to be joined together. Figure 5 shows the fully placed rivet, where it will be seen that a hole 35 of appropriate diameter has been bored through the superposed frame member 12 and into the softwood panel 11. This hole should be at least long enough to accommodate the length of the assembled rivet, when the underface of the shell head 18 is pressed into contact with the near face of the frame 12. In this example, the blind end of the hole 35 comes near to, but does not break through, the remote or inaccesible face 36 of the panel 11, since it is required that this face is visually unmarked.

The rivet is placed by a blind-rivet placing tool of well-known type. This has an annular anvil which

abuts the head 18 of the rivet shell, and stem-gripping and pulling jaws which grip the pulling portion of the stem and apply an increasing tension force to it with respect to the shell head. This causes the cutting edges 24 and the remainder of the stem expander head 29 to progressively enter the weakened portion 19 of the shell. The progressively increasing diametral dimensions of the leading parts 24a of the cutting edges cut into the weakened portion 19 of the shell, which ruptures along the cutting lines and splits into four legs 37. The progressively increasing diametral dimensions of the cutting edges 24a and the surface 32 of the head cause the legs to bend outwardly about their inner ends under the force of the advancing head, the legs 37 displacing and compressing the softwood material. The taper 34 on the stem eases the progressive entry of the retaining portion 33 of the stem along the bore. The slightly enlarged retaining portion 33 of the stem axially lengthens its interference fit with the wall of the shell bore. This may cause a very slight radial expansion of the outside of the shell to axially extend towards the shell head. The stem head 29 advances until resistance to the cutting edges and underhead face of the head increases substantially, when they reach the region of the inner end of the weakened portion 19 and the annular shoulder 23, where the shell becomes stronger and much more resistant to rupture and deformation. In addition, the part of the wood 11 surrounding the legs 37, which has been compressed by the legs as they are forced outwardly, resists further outward movement of the legs, which in turn resists further movement of the stem head along the shell.

Thus, the strength of the breakneck, and the resistance of the main part of the shank 17 of the body to further rupture by the cutting edges and deformation by the stem head, are so related that the breakneck is not sufficiently strong to transmit the force necessary to cause further rupture and deformation of the shank 17.

As the tension applied to the stem pulling portion 26 by the rivet placing tool continues to increase, the stem fractures at the breakneck 27, which is by then located inside the shell head 18. The rivet is thus anchored in the softwood panel 11 by means of the outwardly deformed legs 37 which are embedded in the material of the wood, as illustrated in Figure 5.

The stem head and plugging portion are retained within the shell by the interference of the enlarged retaining portion 33 with the adjacent part of the shell shank. The presence of the stem head in abutment with the deformed legs 37 of the shell tail restrains the legs against inward collapse, which would weaken the strength of the riveted joint.

It should be noted that the major anchoring deformation of the legs 37 is spaced well away from the surface of the softwood panel 11 which is in contact with the frame member 12, so that there is plenty of wood material undisturbed adjacent the wall of the hole 35 to be strong enough to resist pull-out of the rivet. This resistance would be reduced by any substantial radial expansion of the part of the shell shank between the legs 37 and the shell head 18, since the amount of material of the softwood which resists pull-out of the expanded legs would be reduced. Any slight expansion of the exterior of the shell shank nearest the weakened portion due to the insertion of the stem retaining portion 33 into the shell bore part 20, has occured on assembly of the rivet, before it is inserted in the hole 35 in the wood. Any axial extension of this slight expansion, when the rivet is installed, has a negligible effect on the resistance to pull-out of the rivet offered by the wood. The disruption of the wood by the legs is also spaced well away from the remote face 36 of the wood panel, thus ensuring that this face is not disturbed.

It is found that, if the hole 35 is rather shorter than is recommended, so that the stem head end face 30 touches the bottom of the hole and the shell head underface cannot intitially touch the frame 12, the action of the legs 37 when the rivet is installed pulls the rivet shell head 18 into contact with the frame 12. This action can also pull the frame into tight contact with the sofft wood panel 11.

It is also found that there is a substantial tolerance in the diameter of the hole 35 in which the installed rivet will still have a substantial resistance to pull-out.

The invention is not restricted to the details of the foregoing example. For instance, the stem head 29 may be formed without the parallel portion 31, the domed end face 30 being directly adjacent the wider end of the underhead curved face 32.

The cutting elements provided in the foregoing example by edges 24, could be provided in any convenient form.

Retention of the stem into the shell of the installed rivet may be achieved by providing a more positive interference between these two parts, e.g. by providing grooves on the stem in which the shell engages.

Claims

1. A blind rivet for anchoring, in relatively soft material, which rivet comprises a tubular shell (14) and a stem (15);

   the tubular shell (14) having a shank (17) and a preformed head (18) at one end of the shank (17), the shank (17) having a main part

adjacent to the preformed head (18) and a weakened expandable portion (19) at the end thereof remote from the head (18), the weakened portion (19) of the shell (14) having a thinner wall (21) than the next adjacent portion of the shell (14);

the stem (15) extending through the tubular shell (14) and having a pulling portion (26), a breakneck (27), and an expander head (29) disposed adjacent to the weakened expandable portion (19) of the shell (14), the expander head (29) having a maximum external diameter greater than the internal diameter of the thinner walled weakened portion (19) of the shell (14), and having a plurality of cutting elements (24) on that side of the head which faces towards the weakened portion (19) of the shell (14); at least part of the expander head (29) increasing in diametral dimension towards the maximum diameter of the head (29); and the main part of the shank (17) being more resistant to rupture and deformation than the weakened portion (19);

such that, when the rivet is inserted into a bore (35) in a body (11) of material so that the expandable portion (19) of the shell (14) is located in the bore (35) and spaced by a sufficient distance from the surface of the material at the accessible end of the bore (35), and increasing tension is applied to the stem (15) on the side of the breakneck (27) remote from the stem head (29), with respect to the head (18) of the shell (14),

the stem head (29) progressively enters the weakened portion (19) of the shell (14), the cutting elements (24) causing the weakened portion (19) of the shell (14) to split into a plurality of legs (37), the progressively increasing diametral dimension of the head (29) causing the legs (37) to be forced outwardly to anchor the rivet in the bore (35) in the body (11) of material,

characterised in that the strength of the breakneck (27), and the resistance of the main part of the shank (17) of the shell (14) to rupture by the cutting elements (24) and deformation by the stem head (29), are so related that the breakneck (27) is not sufficiently strong to transmit the force necessary to cause further rupture and deformation of the shank (17), so that the stem breakneck (27) fractures before the stem head (29) can advance substantially further into the shell (17) beyond the weakened portion (19), thereby confining the splitting of the shell (14) into radially expanded legs (37) embedded in the material at the end of the shell spaced away from the surface of the material at the accessible end of the bore (35), with no substantial expansion of at least the major part of the remaining length of the shell shank (17).

2. A rivet as claimed in claim 1, characterised in that the weakened portion (19) of the shell (14) has the same external diameter as the next adjacent part of the shell (14).

3. A rivet as claimed in claim 2, characterised in that the inner end of the weakened portion (19) meets the next adjacent part of the shell (14) at an annular shoulder (23).

4. A rivet as claimed in any of the preceding claims, characterised in that the shell shank (17) has a uniform external diameter.

5. A rivet as claimed in claim 1, characterised in that the cutting elements (24) on the stem head (29) comprise cutting edges (24a,24b).

6. A rivet as claimed in claim 5, characterised in that the cutting edges (24a, 24b) each comprise at least a part (24b) which slopes radially outwardly.

7. A rivet as claimed in claim 6, characterised in that the cutting edges (24a, 24b) each comprise a further part (24a) which is parallel to the stem axis.

8. A rivet as claimed in any of the preceding claims, characterised in that the shape of the stem head (29) progressively increases as aforesaid from the diameter of the adjacent part (33) of the cutting elements (24) to the maximum diameter of the head (29).

9. A rivet as claimed in claim 8, characterised in that the shape of the stem head (29) progressively increases in diameter as aforesaid in a smooth arcuate curve.

10. A rivet as claimed in any of the preceding claims, characterised in that it includes means for retaining the stem head (29) in engagement with the outwardly deformed legs (37) to restrain them against subsequent inwards collapse.

11. A rivet as claimed in claim 10, characterised in that the retaining means is provided by part (33) of the stem which has a diameter greater than the internal diameter of the main part of the shell bore (16) into which it has been drawn.

12. A rivet as claimed in claim 10, characterised in that the retaining means part (33) of the stem (15) of greater diameter extends up to or substantially up to the breakneck (27).

13. A rivet as claimed in claim 12, characterised in that the retaining means part (33) of the stem (15) is joined to the breakneck (27) by a taper (34).

Patentansprüche

1. Blindniet zur Verankerung in vergleichsweise weichem Material, wobei der Niet eine rohrförmige Hülse (14) und einen Dorn (15) aufweist;
die rohrförmige Hülse weist einen Schaft (17) und einen vorgeformten Kopf (18) an einem Ende des Schaftes (17) auf, der Schaftt (17) besteht aus einem Hauptteil nahe dem vorgeformten Kopf (18) und einem geschwächten, aufweitbaren Abschnitt (19) an dem von dem Kopf (18) entfernt liegenden Ende, wobei der geschwächte Abschnitt (19) der Hülse (14) eine dünnere Wandung (21) als der nächst anschließende Abschnitt der Hülse (14) aufweist;
der Dorn (15) erstreckt sich durch die rohrförmige Hülse (14) und weist einen Zugabschnitt (26), eine Sollbruchstelle (27) und einen Aufweitkopf (29) auf, welcher nahe dem geschwächten, aufweitbaren Abschnitt (19) der Hülse (14) angeordnet ist, wobei der Aufweitkopf (29) einen maximalen Außendurchmesser größer als der Innendurchmesser des dünnerwandigen, geschwächten Abschnitts (19) der Hülse (14) aufweist und eine Vielzahl von Schneidelementen (24) auf der Seite des Kopfes angeordnet ist, welche in Richtung des geschwächten Abschnitts (19) der Hülse (14) weist; mindestens ein Teil des Aufweitkopfes (29) nimmt in diametraler Richtung in Richtung des Maximaldurchmessers des Kopfes (29) zu, wobei der Hauptteil des Schaftes (17) gegen Aufreißen und Deformation einen höheren Widerstand aufweist als der geschwächte Abschnitt (19),
derart, daß, wenn der Niet in eine Bohrung (35) in einem Körper (11) aus Material eingesetzt wird, so daß der aufweitbare Abschnitt (19) der Hülse (14) in der Bohrung (35) angeordnet und in einem ausreichenden Abstand von der Oberfläche des Materials an dem zugänglichen Ende der Bohrung (35) befindlich ist und eine zunehmende Zugspannung auf den Dorn (15) auf der Seite der Sollbruchstelle (27) bezüglich des Kopfes (18) der Hülse (14) ausgeübt wird, welche von dem Dornkopf (29) entfernt liegt,
der Dornkopf (29) fortschreitend in den geschwächten Abschnitt (19) der Hülse (14) eindringt, die Schneidelemente (24) bewirken, daß der geschwächte Abschnitt (19) der Hülse (14) in eine Vielzahl von Schenkel (37) aufgespalten wird, wobei die fortschreitend zunehmende, diametrale Abmessung des Kopfes (29) bewirkt, daß die Schenkel (37) nach außen zum Verankern des Niets in der Bohrung (35) des Körpers (11) aus Material gedrückt werden,
dadurch gekennzeichnet, daß die Festigkeit der Sollbruchstelle (27) und der Widerstand des Hauptteils des Schaftes (17) der Hülse (14) gegen Aufreißen durch die Schneidelemente (24) und Deformation durch den Dornkopf (29) derart miteinander in Beziehung stehen, daß die Sollbruchstelle (27) nicht ausreichend fest ist, um die Kraft zu übertragen, welche notwendig ist, ein weiteres Aufreißen und Deformation des Schaftes (17) zu bewirken, so daß die Sollbruchstelle (27) des Dorns abreißt, ehe der Dornkopf (29) wesentlich weiter in die Hülse (17) über den geschwächten Abschnitt (19) hinaus eindringen kann, so daß das Spalten der Hülse (14) in radial aufgeweitete Schenkel (37) begrenzt ist, die in das Material an dem im Abstand von der Oberfläche des Materials am zugänglichen Ende der Bohrung (35) liegenden Ende der Hülse eingebettet sind, wobei keine wesentliche Expansion mindestens des größeren Teils der verbleibenden Länge des Hülsenschaftes (17) erfolgt.

2. Blindniet nach Anspruch 1, dadurch gekennzeichnet, daß der geschwächte Abschnitt (19) der Hülse (14) den gleichen Durchmesser wie der anschließende Teil der Hülse (14) aufweist.

3. Blindniet nach Anspruch 2, dadurch gekennzeichnet, daß das Innenende des geschwächten Abschnitts (19) in den benachbarten Teil der Hülse (14) an einer ringförmigen Schulter (24) übergeht.

4. Blindniet nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, daß der Hülsenschaft (17) einen gleichmäßigen Außendurchmesser aufweist.

5. Blindniet nach Anspruch 1, dadurch gekennzeichnet, daß die Schneidelemente (24) an dem Dornkopf (29) durch Schneidkanten (24a, 24b) gebildet sind.

6. Blindniet nach Anspruch 5, dadurch gekennzeichnet, daß die Schneidkanten (24a, 24b) je mindestens einen Teil (24b) aufweisen, welcher radial nach außen abfällt.

7. Blindniet nach Anspruch 6, dadurch gekennzeichnet, daß die Schneidkanten (24a, 24b) je weiterhin einen Teil (24a) aufweisen, welcher parallel zur Achse des Dorns liegt.

8. Blindniet nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, daß die Form des Dornkopfs (29) fortschreitend in der vorgenannten Weise von dem Durchmesser des naheliegenden Teils (33) der Schneidelemente (24) auf den Maximaldurchmesser des Kopfes (29) zunimmt.

9. Blindniet nach Anspruch 8, dadurch gekennzeichnet, daß die Form des Dornkopfes (29) fortschreitend im Durchmesser in einer stetigen bogenförmigen Kurve zunimmt.

10. Blindniet nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, daß er Einrichtungen aufweist, um den Dornkopf (29) in Eingriff mit den nach außen verformten Schenkeln (37) zu halten, um diese gegen eine nach innen gerichtete Zusammenfaltung abzustützen.

11. Blindniet nach Anspruch 10, dadurch gekennzeichnet, daß die Halteeinrichtungen durch einen Teil (33) des Dorns gebildet sind, welcher einen Durchmesser aufweist, der größer ist als der Innendurchmesser des Hauptteils der Hülsenbohrung (16), in welche er hineingezogen wurde.

12. Blindniet nach Anspruch 10, dadurch gekennzeichnet, daß der Teil (33) der Halteeinrichtung des Dorns (15) mit größerem Durchmesser sich bis zu oder im wesentlichen bis zu der Sollbruchstelle (27) erstreckt.

13. Blindniet nach Anspruch 12, dadurch gekennzeichnet, daß der Teil (33) der Halteeinrichtung des Dorns (15) über eine Abschrägung (34) mit der Sollbruchstelle (27) verbunden ist.

Revendications

1. Rivet aveugle pour l'ancrage dans un matériau relativement mou, ce rivet comprenant une coque tubulaire (14) et une tige (15);

la coque tubulaire (14) comprenant un tronc (17) et une tête préformée (18) à une extrémité du tronc (17), le tronc (17) comprenant une partie principale adjacente à la tête préformée (18) et une partie expansible affaiblie (19) située à son extrémité éloignée de la tête (18), la partie affaiblie (19) du tronc (17) ayant une paroi (21) plus mince que la partie suivante adjacente de la coque (14);

la tige (15) traversant la coque tubulaire (14) et comprenant une partie de tirage (26), un col de rupture (27) et une tête formant dispositif d'expansion (29) disposée au voisinage de la partie expansible affaiblie (19) de la coque (14), la tête formant dispositif d'expansion (29) ayant un diamètre extérieur maximum supérieur au diamètre intérieur de la partie affaiblie à paroi plus faible (19) de la coque (14) et présentant une pluralité d'éléments de coupe (24) sur le côté de la tête tourné vers la partie affaiblie (19) de la coque (14); au moins une partie de la tête formant le dispositif d'expansion (29) ayant une dimension diamétrale qui augmente en direction du diamètre maximum de la tête (29);

et la partie principale du tronc (17) étant plus résistante à la rupture et à la déformation que la partie affaiblie (19);

si bien que, lorsque le rivet est inséré dans un trou (35) ménagé dans un corps (11) dudit matériau de telle sorte que la partie expansible (19) de la coque (14) est située dans le trou (35) et est séparée, par une distance suffisante, de la surface du matériau à l'extrémité accessible du trou (35), et qu'une tension croissante est appliquée à la tige (15) du côté dudit col de rupture (25) qui est éloigné de la tête (29) de la tige par rapport à la tête (18) de la coque (14),

la tête (29) de la tige pénètre progressivement dans la partie affaiblie (19) de la coque (14), les éléments de coupe (24) amenant la partie affaiblie (19) de la coque (14) à se diviser en une pluralité de branches (37), l'accroissement progressif de la taille diamétrale de la tête (29) repoussant à force les branches (37) vers l'extérieur de manière à ancrer le rivet dans le trou (35) ménagé dans le corps (11) de matériau,

caractérisé en ce que la solidité du col de rupture (27) et la résistance de la partie principale de la tige (17) de la coque (14) à la rupture sous l'effet des éléments de coupe (24) et de la déformation produite par la tête (22) de la tige, sont associées de telle sorte que le col de rupture (27) n'est pas suffisamment robuste pour transmettre la force nécessaire pour provoquer une rupture et une déformation supplémentaire de la tige (17), si bien que le col de rupture (25) de la tige se rompt avant que la tête de la tige (22) puisse pénétrer nettement plus loin dans la coque (17) au-delà de la partie affaiblie (19), ce qui limite la division de la coque (14) à des branches (37) élargies radialement et enfoncées dans le matériau à l'extrémité de la coque qui est espa-

cée de la surface du matériau au niveau de l'extrémité accessible du trou (35), sans aucune expansion importante d'au moins la majeure partie de la longueur restante de la tige (17) de la coque.

2. Rivet selon la revendication 1, caractérisé en ce que la partie affaiblie (19) de la coque (14) a le même diamètre extérieur que la partie suivante adjacente de la coque (14).

3. Rivet selon la revendication 2, caractérisé en ce que l'extrémité intérieure de la partie affaiblie (19) se raccorde à la partie suivante adjacente de la coque (14) au niveau d'un épaulement annulaire (23).

4. Rivet selon l'une quelconque des revendications précédentes, caractérisé en ce que la tige (17) de la coque a un diamètre extérieur uniforme.

5. Rivet selon la revendication 1, caractérisé en ce que les éléments de coupe (24) présents sur la tête (22) de la tige comprennent des arêtes de coupe (24a, 24b).

6. Rivet selon la revendication 5, caractérisé en ce que les arêtes de coupe (24a, 24b) comprennent chacune au moins une partie (24b) qui est inclinée radialement vers l'extérieur.

7. Rivet selon la revendication 6, caractérisé en ce que les arêtes de coupe (24a, 24b) comprennent chacune une autre partie (24a), qui est parallèle à l'axe de la tige.

8. Rivet selon l'une quelconque des revendications précédentes, caractérisé en ce que la forme de la tête (29) de la tige augmente progressivement comme indiqué précédemment depuis le diamètre de la partie adjacente (33) des éléments de coupe (24) jusqu'au diamètre maximum de la tête (29).

9. Rivet selon la revendication 8, caractérisé en ce que la forme de la forme de la tête (29) de la tige augmente progressivement, comme indiqué précédemment, selon un tracé à courbure régulière.

10. Rivet selon l'une quelconque des revendications précédentes, caractérisé en ce qu'il comprend des moyens pour retenir la tête (29) de la tige en engagement avec les branches (37) déformées par refoulement vers l'extérieur, de manière à empêcher leur rapprochement ultérieur vers l'intérieur.

11. Rivet selon la revendication 10, caractérisé en ce que les moyens de retenue sont formés par une partie (33) de la tige, qui a un diamètre supérieur au diamètre intérieur de la partie principale du trou (16) de la coque, dans lequel elle a été introduite.

12. Rivet selon la revendication 10, caractérisé en ce que la partie (33) constituant les moyens de retenue de la tige (15), de diamètre supérieur, s'étend sensiblement jusqu'au col de rupture (27).

13. Rivet selon la revendication 12, caractérisé en ce que la partie constituant des moyens de retenue (33) de la tige (15), se raccorde au col de rupture (27) par une partie conique (34).

Fig.1.

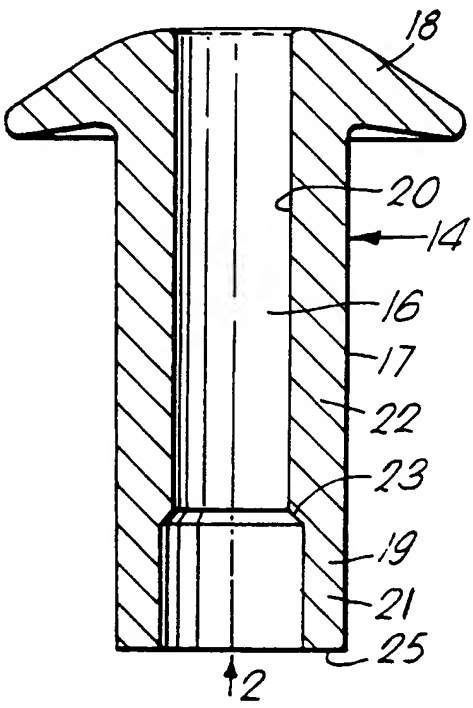

Fig.2.

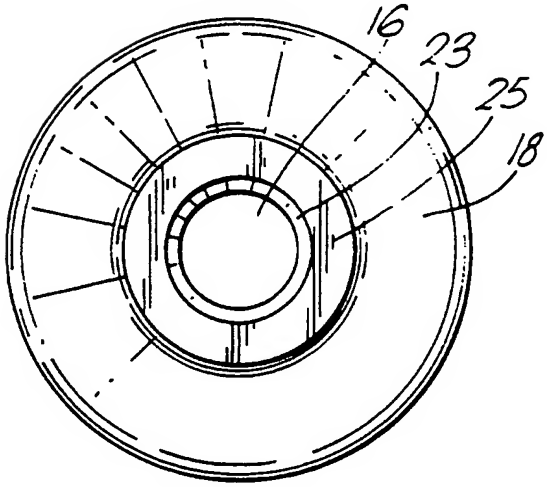

Fig.3B

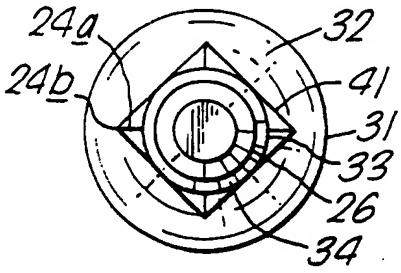

Fig.3A.

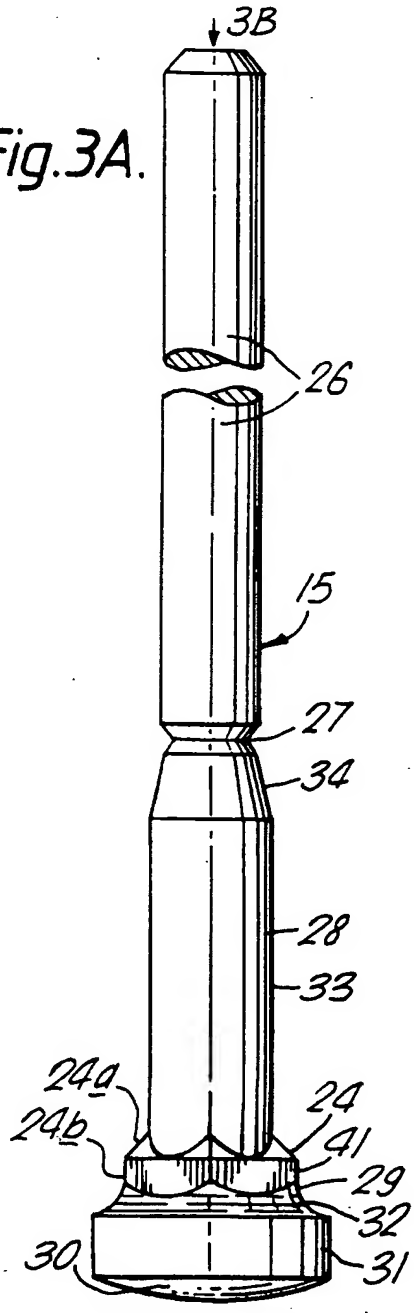

Fig.4.

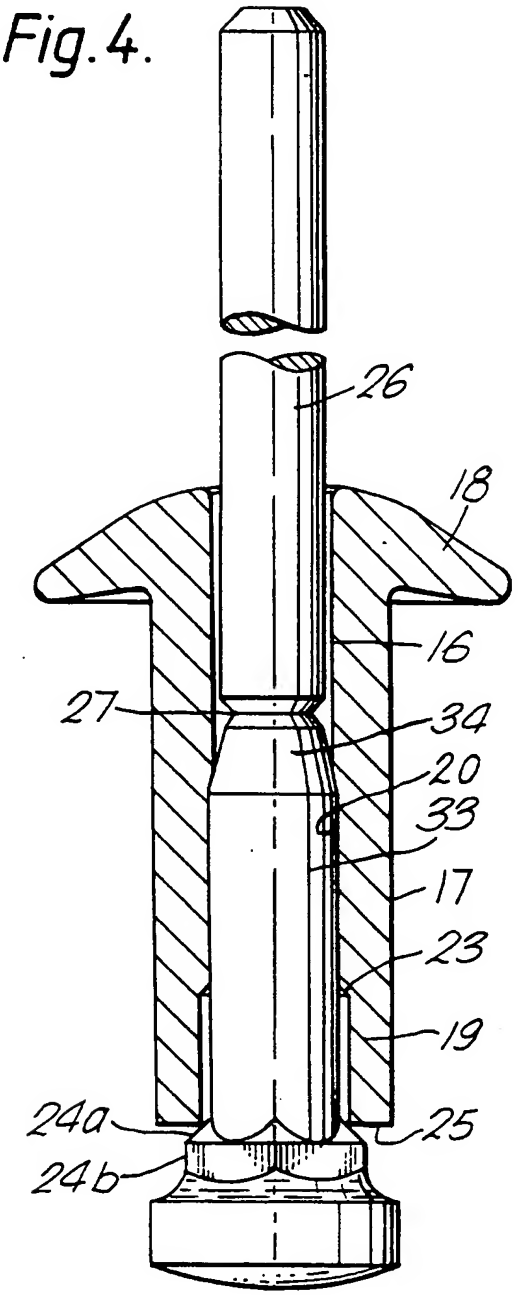

Fig.5.

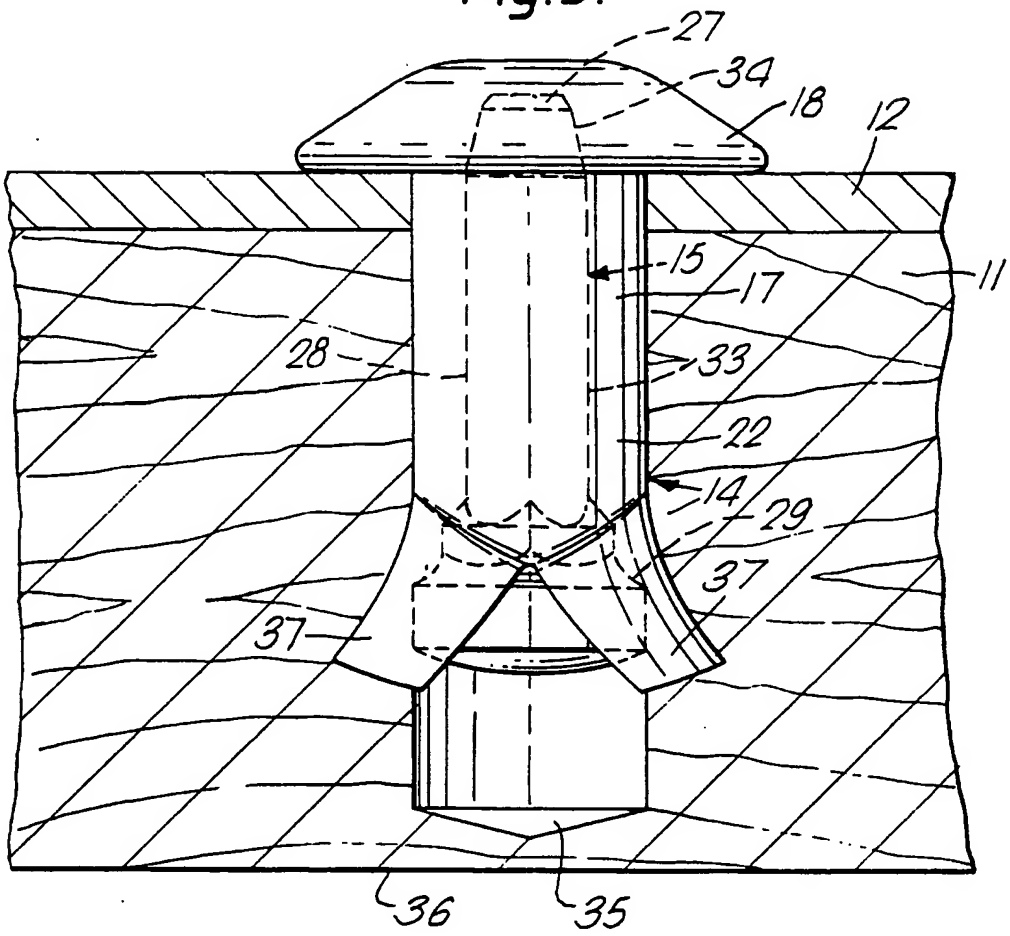

Fig.6.